

Sudershan Boovaraghavan

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OVERVIEW

A computer scientist specializing in interdisciplinary research across **systems, applied machine learning (ML), Internet of Things (IoT), and health** domains. Expertise in developing **large-scale sensing systems** and **foundational machine-learning models** for human activity recognition and health applications.

EDUCATION

Carnegie Mellon University

Doctor of Philosophy in Computer Science - Societal Computing

Master of Science in Societal Computing

Advisor: Yuvraj Agarwal || CMU Presidential Fellowship 2023 🎓

Thesis: "Towards Enabling General-Purpose Sensing Systems"

Pittsburgh, PA

Aug 2018 – Aug 2024 (expected)

SRM University

Bachelor of Technology in Computer Science and Engineering

Chennai, India

Jun 2012 – Jun. 2016

SKILLS

Programming: Python, C, C++, Java, HTML, CSS, Javascript, Node.js, Vue.js, D3.js, React, GraphQL

ML and Data Analysis tools: TensorFlow, PyTorch, Keras, Scikit-learn, Spark, Flink, Prometheus, Grafana

WebFrameworks/Databases: Flask, FastAPI, Streamlit, Nginx, MySQL, MongoDB, InfluxDB, Bigtable

PHD RESEARCH

Carnegie Mellon University

Advisor: Yuvraj Agarwal || Collaborator(s): Chris Harrison and Mayank Goel

Pittsburgh, PA

Aug 2018 – Present

Building a General-Purpose Sensing Infrastructure || Paper(s) : P.1, P.4, P.6 || 🎓 www.mites.io

- Developed Mites.io, a multimodal sensing platform to provide high-fidelity sensing of ambient environment.
- Built hardware and firmware, achieving accurate sub-second event capture with real-time edge processing.
- Architected a fault-tolerant distributed backend using Node.js and Python with dynamic load balancing, low latency data streaming, storage, and seamless over-the-air firmware updates.
- Implemented edge ML approaches for speech filtering in audio-based activity recognition to preserve privacy.
- Led the deployment of 300+ Mites devices in the CMU building, serving 400+ occupants and enabling applications such as space utilization and activity tracking, establishing one of the largest IoT deployments.

Production-scale Machine Learning Platform for the Internet of Things || Paper(s) : P.2

- Designed MLIoT, a scalable ML platform automating model training, optimization, and serving for IoT applications using user- and application-driven policies.
- Engineered the system to adapt to IoT environments, diverse data sources, and compute resources, outperforming Google TFX by 50%-75% in accuracy with reduced latency.
- Explored foundational models with unlabeled multimodal data, capturing temporal relationships accurately.

Understanding Activity Contexts for Wellness Applications || Paper(s) : P.5 || 🎓 Github

- Devised TAO, a framework with OWL-based ontology and temporal clustering for activity context detection.
- Achieved near-ground-truth accuracy in wellness metrics for productivity and stress assessment.

ADDITIONAL RESEARCH EXPERIENCE

Carnegie Mellon University

Research Associate || Advisor(s): Yuvraj Agarwal, Anind K. Dey and Raj Reddy

Pittsburgh, PA

Jan 2016 – Aug 2018

Safe and Secure Building Operating System || Paper(s) : D.1, D.2, D.3 || 🎓 buildingdepot.org

- Implemented BuildingDepot, a distributed building OS with features for sensor data storage, access control, and actuation with a robust RabbitMQ-based stream processing. Managed IoT test bed deployments at CMU and Google, using the OS as middleware, and created apps for the GIOTTO project (🎓 iotexpedition.org).

SELECTED PUBLICATIONS (🔗 FULL LIST)

- [P.6] **Sudershan Boovaraghavan**, Haozhe Zhou, Mayank Goel, and Yuvraj Agarwal. 2024. Kirigami: Lightweight Speech Filtering for Privacy-Preserving Activity Recognition using Audio. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 8, 1, Article 36 (**Ubicomp '24**).
- [P.5] **Sudershan Boovaraghavan**, Prasoon Patidar, and Yuvraj Agarwal. 2023. TAO: Context Detection from Daily Activity Patterns Using Temporal Analysis and Ontology. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 7, 3, Article 87 (**Ubicomp '23**).
- [P.4] **Sudershan Boovaraghavan**, Chen Chen, Anurag Maravi, Mike Czapik, Yang Zhang, Chris Harrison, and Yuvraj Agarwal. 2023. Mites: Design and Deployment of a General-Purpose Sensing Infrastructure for Buildings. *Proc. ACM Interact. Mob. Wearable Ubiquitous Technol.* 7, 1, Article 2 (**Ubicomp '23**).
- [P.3] Abdelkareem Bedri, Yuchen Liang, **Sudershan Boovaraghavan**, Geoff Kaufman, and Mayank Goel. 2022. FitNibble: A Field Study to Evaluate the Utility and Usability of Automatic Diet Monitoring in Food Journaling Using an Eyeglasses-based Wearable. In *27th International Conference on Intelligent User Interfaces (IUI '22)*. ACM, New York, NY, USA.
- [P.2] **Sudershan Boovaraghavan**, Anurag Maravi, Prahaladha Mallela, and Yuvraj Agarwal. 2021. MLIoT: An End-to-End Machine Learning System for the Internet-of-Things. In *Proceedings of the International Conference on Internet-of-Things Design and Implementation (IoTDI '21)*. ACM, New York, NY, USA.
- [P.1] Jason Koh, Dezhi Hong, Shreyas Nagare, **Sudershan Boovaraghavan**, Yuvraj Agarwal, and Rajesh Gupta. 2019. Who can Access What, and When? Understanding Minimal Access Requirements of Building Applications. In *Proceedings of the 6th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys '19)*. ACM, New York, NY, USA.

PREPRINTS

- [R.1] Matùš Tomlein, **Sudershan Boovaraghavan**, Yuvraj Agarwal, and Anind K. Dey. “Supporting Maintenance Operations for Activity Recognition Using Transfer Learning.” (2018) arXiv preprint.

POSTERS & DEMOS

- [D.3] Matilda Kathryn Ferguson, **Sudershan Boovaraghavan**, and Yuvraj Agarwal. 2020. Vista: Spatial Data Representation for Smart Buildings. In *Proceedings of the 7th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys '20)*. Association for Computing Machinery, New York, NY, USA, 342–343. [**Best Demo Award**]
- [D.2] **Sudershan Boovaraghavan**, Chen Chen, Dohyun Kim, Yuvraj Agarwal, “GioTTO: A Safe, Secure and Easy to Use IoT Stack for Buildings,” CMU Energy Week, March 2018, Pittsburgh, PA, USA.
- [D.1] Matùš Tomlein, **Sudershan Boovaraghavan**, Yuvraj Agarwal, and Anind K. Dey. 2017. CharIoT: an end-user programming environment for the IoT. In *Proceedings of the Seventh International Conference on the Internet of Things (IoT '17)*. ACM, New York, NY, USA, Article 25, 1–2.

PATENTS

- [T.1] Yuvraj Agarwal, Chris Harrison, Gierad Laput, **Sudershan Boovaraghavan**, Chen Chen, Abhijit Hota, Robert Xiao, and Yang Zhang. Virtual Sensor System. U.S. Patent Application 16/591,987. [**Accepted**]

TEACHING EXPERIENCE

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| Teaching Assistant, Carnegie Mellon University | Pittsburgh, PA |
| <i>17-734,05-836,19-534: Usable Privacy and Security (Undergraduate & Graduate)</i> | Jan 2024 – May 2024 |
| Teaching Assistant, Carnegie Mellon University | Pittsburgh, PA |
| <i>17-722,05-499: Building User-Focused Sensing Systems (Undergraduate & Graduate)</i> | Jan 2020 – May 2020 |